Space Weather Technical Forecast

Issued on Friday, 28 January 2022 at 12:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance G1/Minor Geomagnetic Storm, mainly today or tomorrow (28th or 29th). Slight chance R1 Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low through the last 24 hours, with five numbered sunspot regions on the visible disc. AR2936 remains the largest and most complex (Dai/beta), with a continued increase in growth in the lead portion, and has produced occasional low level C-flares. AR2938 has shown weakening in some of its minor spots. AR2934 and 2937 have shown little change. AR2935 has exhibited some waxing/waning of its constituent minor spots.

No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 has fluctuated between 430-540km/s. The density was predominantly at average levels, but temporarily reached above average levels through the afternoon UTC of the 27th. The total field strength (IMF) Bt, varied 3-9nT. The north-south component, Bz, remained weak and variable ranging between +6nT and -5nT. Phi angle was generally positive (away from the Sun), but with some brief negative fluctuations. Geomagnetic Activity remain Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV), was at background to moderate levels, peaking at 379 pfu at 27/1735 UTC. The associated electron fluence was below the Active threshold (1e8 integrated flux), with 4.61e6 recorded at 28/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity has been Low, with the most recent C-class originating from AR2936 in the northeast quadrant. Low activity is expected to continue, with a slight chance of isolated M-class flares, these again most likely from AR2936.

Solar Wind / Geomagnetic Activity: There is one CME on the Earth-Sun line that has been assessed, but currently expected to pass close to Earth around 29/0000 UTC, although a glancing impact is possible. A further weak CME may brush Earth on the 30th, but this is lower confidence. Between the potential CME arrivals, and also the influence of a slight enhancement from CH47 through today, solar winds are expected to be slightly elevated to elevated, likely peaking around 550km/s, before gradually easing to become background to slightly elevated levels through day 4 (31st). Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) increasing occasionally Active (Kp 4) today, tomorrow and during day 3 (30th) with a slight chance of G1/Minor Storm (Kp 5) intervals.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is forecast to remain at background levels. The high energy electron flux (greater than 2MeV) is

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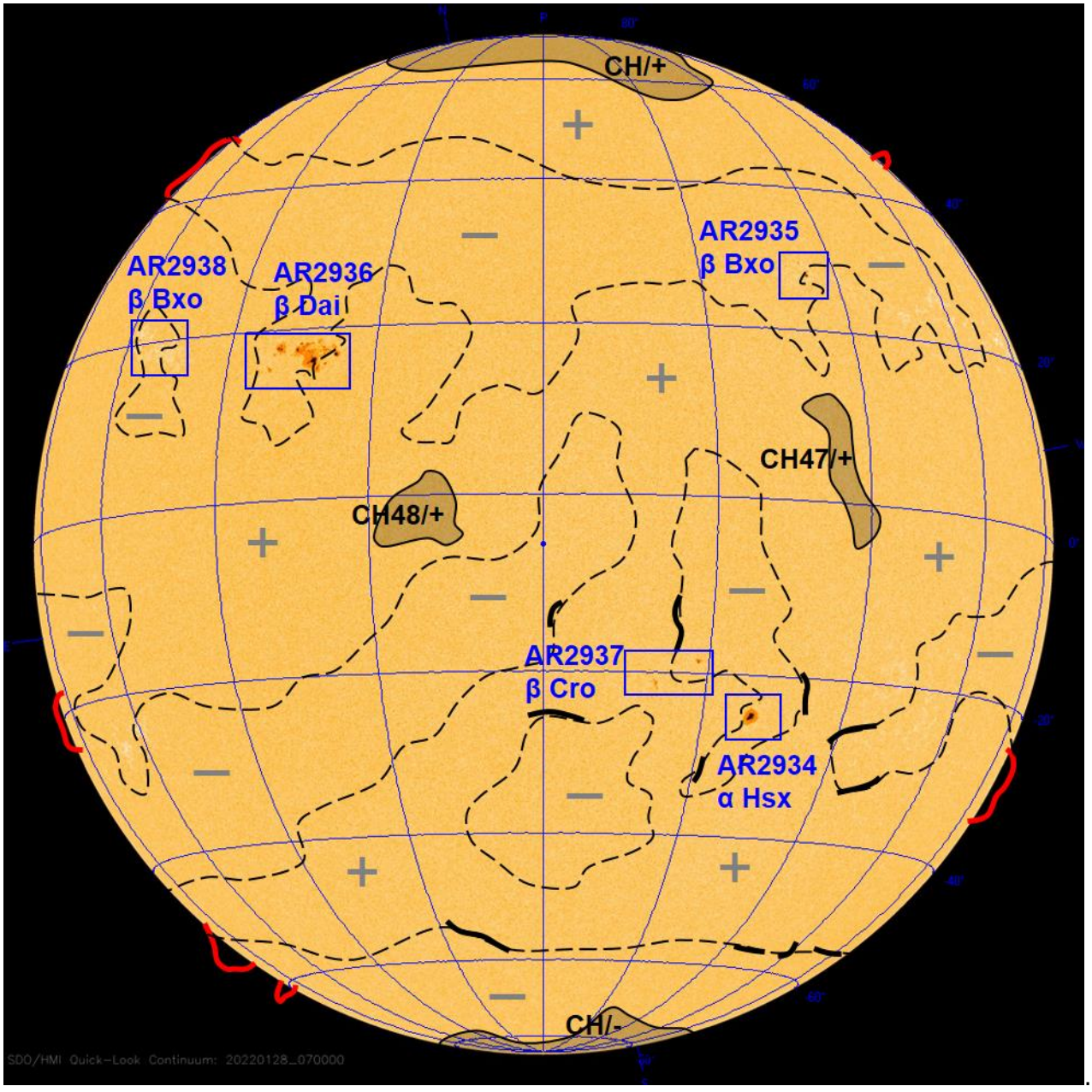
expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially during days 3 and 4 (30th and 31st). The associated 24hr fluence is expected to remain below the Active threshold, despite an increasing trend.

Figure 1. Solar Analysis Valid 28/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There is one CME currently expected to pass near Earth during the forecast period, however the bulk of this CME is forecast to miss passing north of the Earths orbital plane. This was from a filament eruption on the 24th, potentially associated with a C2-flare. This has a chance of glancing influence around 29/0000UTC. A filament eruption at 26/1945 UTC, from near AR2934, has been modelled and could give an Earth-directed glance on the 30th, although this is low confidence.

Between the potential CME arrivals, and also the influence of a slight enhancement from CH47 through today, solar winds are expected to remain slightly elevated to elevated, likely peaking around around 550km/s, before gradually easing to become background to slightly elevated levels through day 4 (31st). This is in-line with expectations from persistence, and also timings of an enhancement seen in STEREO A PLASTIC data, although this is contaminated with a CME arrival.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) increasing occasionally Active (Kp 4) today, tomorrow and during day 3 (30th) with a slight chance of G1/Minor Storm (Kp 5) intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
25/0220	Partial	Filament	N23 E001	376	29/0000 UTC	Glancing blow
27/0501	Partial	Filament	S23 W012	411	30/1200 UTC	Very low confidence of any impacts

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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Solar Activity has been Low. There are five numbered sunspot regions. AR2936 remains the largest and most complex (Dai/beta), with a continued increase in growth in the lead portion, and has produced occasional low level C-flares. AR2938 has shown weakening in some of its minor spots. AR2934 and 2937 have shown little change. AR2935 has exhibited some waxing/waning of its constituent minor spots.

Low solar activity is expected to continue, with a slight chance of isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. No solar radiation storms are expected in the period.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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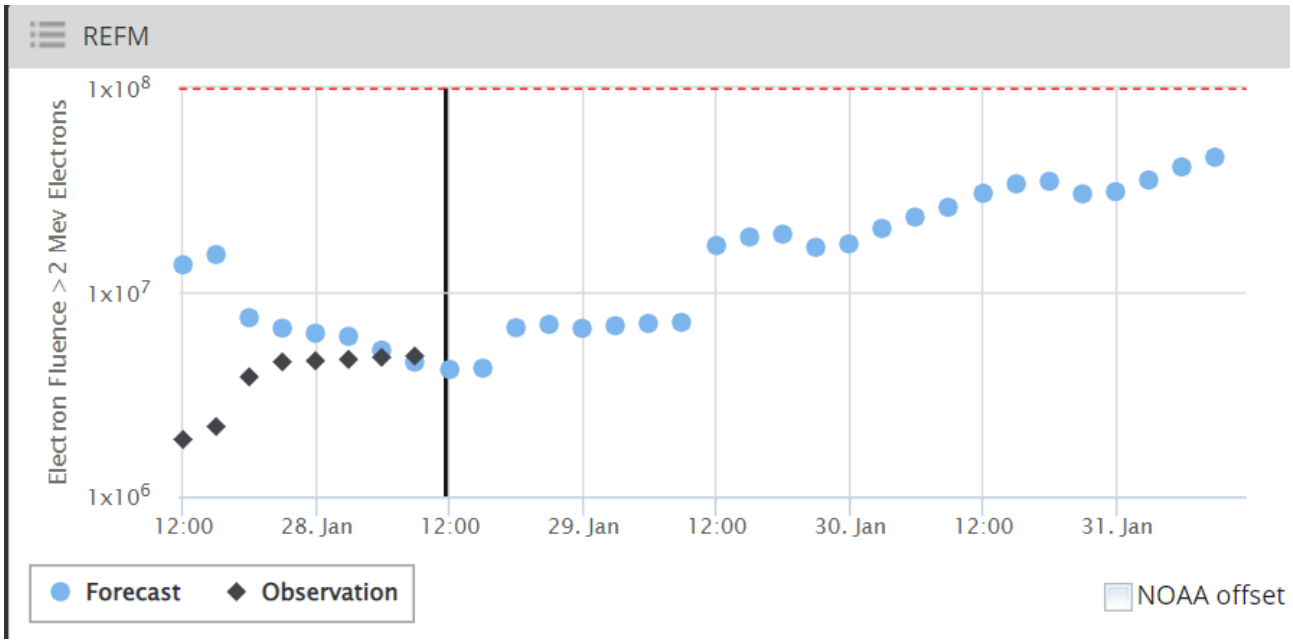
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) as observed by GOES-16 at GEO, was at background to moderate levels, peaking at 379 pfu at 27/1735 UTC during the previous 24 hours. The high energy electron flux is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially during days 3 and 4 (30th and 31st).

With only a limited flux response anticipated from either fast wind enhancement, the associated 24hr fluence is expected to remain below the Active (1e8 integrated pfu) level despite an increasing trend. The Met Office REFM supports fluence levels remaining below the Active period, and is considered to be giving good guidance at this stage.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	10	20	40
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 2: MOSWOC REFM



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